

SEQUENCE LISTING

09/673133

<110> Myers, Lisa E
 Schryvers, Anthony B
 Harkness, Robin E
 Loosmore, Sheena M
 Du, Run-Pan
 Yang, Yan-Ping
 Klein, Michel H

<120> TRANSFERRIN RECEPTOR GENES OF MORAXELLA

<130> 1038-1102 MIS

<140> 09/673,133

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<150> 09/059,584

<151> 1998-04-14

<150> PCT/CA99/00307

<151> 1999-04-12

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<170> PatentIn Ver. 2.1

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<213> Moraxella catarrhalis

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Thr Pro Ile Pro Asn Ala Ser Gly Ser Gly Asn Thr Gly Asn Thr Gly
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Asn Ala Gly Gly Thr Asp Asn Thr Ala Asn Ala Gly Asn Thr Gly Gly
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Thr Asn Ser Gly Thr Gly Ser Ala Asn Thr Pro Glu Pro Lys Tyr Lys
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Asp Val Pro Thr Asp Glu Asn Lys Lys Asp Glu Val Ser Gly Ile Gln
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<213> *Moraxella catarrhalis*

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Gln Asp Val Pro Thr Asp Lys Asn Lys Lys Asp Glu Val Ser Gly Ile
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Gln Glu Pro Ala Met Gly Tyr Gly Val Glu Leu Lys Leu Arg Asn Trp
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Val Lys Leu Glu Gly Asp Leu Lys His Asn Pro Phe Asp Asn Ser Ile
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Trp Gln Asn Ile Lys Asn Ser Lys Glu Val Gln Thr Val Tyr Asn Gln
145 150 155 160

Glu Lys Gln Asn Ile Glu Asn Gln Ile Lys Lys Glu Asn Lys Glu Leu
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 Asp Lys Thr Ala Leu Lys Ala Leu Ile Glu Lys Val Leu Asp Asp Tyr
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 Ser Gly Tyr Ile Tyr Arg Ser Gly Tyr Ser Asn Ile Asp Ile Gln Lys
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 260 265 270
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Ile Asp Leu Thr Gln Gly Asn Asp Phe Val Lys Thr Ile Asp Lys Glu
485 490 495

Lys Pro Ala Thr Thr Thr Asn Gln Ala Gly Glu Pro Leu Thr Val Asn
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Asp Lys Val Arg Val Gln Val Cys Cys Ser Asn Leu Glu His Leu Lys
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Gly Asn Ala Lys Tyr Arg Gly Thr Trp Ala Gly Tyr Val Ala Gly Ser
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Gly Asn Thr Ser Lys Ala Tyr Glu Ala Gln Gln Phe Ala Asp Asn Ala
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Asn Arg Ala Glu Phe Asp Val Asp Phe Ala Asn Lys Ser Leu Thr Gly
595 600 605

Lys Leu Ile Pro Asn Thr Ser Ser Asp Gly Lys Ser Ala Phe Asp Ile
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Thr Ala Thr Ile Asp Gly Asn Gly Phe Ser Gly Lys Ala Asn Thr Pro
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Asp Ile Glu Thr Gly Gly Leu Lys Ile Asp Ser Lys Asn Ser Glu Ser
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Gly Arg Val Ile Val Lys Asp Ala Ile Val Ile Gly Gly Phe Tyr Gly
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Pro Gln Ala Asn Glu Leu Gly Gly Ser Phe Thr Tyr Lys Ser Asn Asp
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<213> *Moraxella catarrhalis*

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<210> 6

<211> 713

<212> PRT

<213> *Moraxella catarrhalis*

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Leu Leu Thr Ala Cys Gly Gly Ser Gly Gly Ser Asn Pro Pro Ala Pro
      20           25           30

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Thr Pro Ile Pro Asn Ala Gly Ser Ala Gly Asn Ala Gly Gly Thr Gly
      35           40           45

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Asn Thr Gly Gly Thr Gly Ser Thr Asp Asn Val Gly Asn Ala Gly Gly
      50           55           60

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Ala Asn Ser Gly Thr Gly Asn Ala Gly Asn Ser Gly Asn Ala Asn Ser
      65           70           75           80

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Gly Thr Gly Ser Ala Asn Thr Pro Glu Pro Lys Tyr Gln Asp Val Pro
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Thr Asp Lys Asn Glu Lys Glu Gln Val Ser Ser Ile Gln Glu Pro Ala
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Met Gly Tyr Ala Met Glu Leu Lys Leu Arg Asn Ala His Pro Leu Asn
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 Asp Leu Ser Ser Glu Gln Lys Glu Ala Lys Val Lys Glu Ala Leu Asp
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<210> 7
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<213> Moraxella catarrhalis

<400> 7

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 Asp Val Pro Thr Glu Lys Asn Glu Lys Asp Lys Val Ser Ser Ile Gln
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 Glu Pro Ala Met Gly Tyr Gly Met Ala Leu Ser Lys Ile Asn Leu His
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 Asn Arg Gln Asp Thr Pro Leu Asp Glu Lys Asn Ile Ile Thr Leu Asp
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 Gly Lys Lys Gln Val Ala Glu Gly Lys Lys Ser Pro Leu Pro Phe Ser
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 Leu Asp Val Glu Asn Lys Leu Leu Asp Gly Tyr Ile Ala Lys Met Asn
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 Val Ala Asp Lys Asn Ala Ile Gly Asp Arg Ile Lys Lys Gly Asn Lys
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 Glu Ile Ser Asp Glu Glu Leu Ala Lys Gln Ile Lys Glu Ala Val Arg
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 Lys Ser His Glu Phe Gln Gln Val Leu Ser Ser Leu Glu Asn Lys Ile
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 Phe His Ser Asn Asp Gly Thr Thr Lys Ala Thr Thr Arg Asp Leu Lys
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 Lys Tyr Lys Gly His Trp Asp Phe Met Thr Asp Val Ala Asn Arg Arg
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 Ser Ala Pro Asp Gly His Ser Gly Glu Tyr Gly His Ser Ser Glu Phe
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 Pro Thr Thr Gly Thr Ala Lys Tyr Leu Gly Asn Trp Val Gly Tyr Ile
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 Gln Asp Val Ala Asp Phe Asp Ile Asp Phe Gly Asn Lys Ser Val Ser
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Gly Lys Leu Ile Thr Lys Gly Arg Gln Asp Pro Val Phe Ser Ile Thr
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Gly Gln Ile Ala Gly Asn Gly Trp Thr Gly Thr Ala Ser Thr Thr Lys
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Ala Asp Ala Gly Gly Tyr Lys Ile Asp Ser Ser Ser Thr Gly Lys Ser
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Ile Val Ile Lys Asp Ala Asn Val Thr Gly Gly Phe Tyr Gly Pro Asn
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Ala Asn Glu Met Gly Gly Ser Phe Thr His Asn Ala Asp Asp Ser Lys
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<211> 714

<212> PRT

<213> Moraxella catarrhalis

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Asn Ala Gly Gly Thr Asp Asn Thr Ala Asn Ala Gly Asn Thr Gly Gly
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Thr Ser Ser Gly Thr Gly Ser Ala Ser Thr Ser Glu Pro Lys Tyr Gln
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Asp Val Pro Thr Thr Pro Asn Asn Lys Glu Gln Val Ser Ser Ile Gln
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Glu Pro Ala Met Gly Tyr Gly Met Ala Leu Ser Lys Ile Asn Leu Tyr
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Asp Gln Gln Asp Thr Pro Leu Asp Ala Lys Asn Ile Ile Thr Leu Asp
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Gly Lys Lys Gln Val Ala Asp Asn Gln Lys Ser Pro Leu Pro Phe Ser
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Leu Asp Val Glu Asn Lys Leu Leu Asp Gly Tyr Ile Ala Lys Met Asn
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Glu Ala Asp Lys Asn Ala Ile Gly Glu Arg Ile Lys Arg Glu Asn Glu
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Gln Asn Lys Lys Ile Ser Asp Glu Glu Leu Ala Lys Lys Ile Lys Glu
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 Ala Lys Thr Phe His Ser Asn Asp Lys Thr Thr Lys Ala Thr Thr Arg
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 Asp Leu Lys Tyr Val Asp Tyr Gly Tyr Tyr Leu Val Asn Asp Ala Asn
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 Tyr Lys Ile Asp Ser Ser Ser Thr Gly Lys Ser Ile Val Ile Lys Asp
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<212> PRT

<213> Moraxella catarrhalis

<400> 9

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Gly Asn Ala Gly Gly Thr Gly Gly Ala Asn Ser Gly Ala Gly Asn Ala
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Gly Gly Thr Gly Gly Ala Asn Ser Gly Ala Gly Ser Ala Ser Thr Pro
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Glu Pro Lys Tyr Lys Asp Val Pro Thr Asp Glu Asn Lys Lys Ala Glu
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Val Ser Gly Ile Gln Glu Pro Ala Met Gly Tyr Gly Val Glu Leu Lys
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Leu Arg Asn Trp Ile Pro Gln Ala Gln Glu Glu His Ala Lys Ile Asn
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Thr Asn Asp Val Val Lys Leu Asp Asn Asp Leu Lys His Asn Pro Phe
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Asp Asn Ser Ile Trp Gln Asn Ile Lys Asn Ser Lys Glu Val Gln Thr
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Val Tyr Asn Gln Glu Lys Gln Asn Ile Glu Asp Gln Ile Lys Arg Glu
 165 170 175

Asn Lys Gln Arg Pro Asp Lys Lys Asp Asp Val Ala Leu Gln Ala Tyr
 180 185 190

Ile Glu Lys Val Leu Asp Asp Arg Leu Thr Glu Leu Ala Lys Pro Ile
 195 200 205

Tyr Lys Lys Asn Thr Asn Tyr Ser His Asp Lys Gln Asn Lys Ala Arg
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Thr Arg Asp Leu Lys Tyr Val Arg Ser Gly Tyr Ile Tyr Arg Ser Gly
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Tyr Ser Asn Ile Ile Pro Lys His Ile Ala Lys Thr Gly Phe Asp Gly
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Ala Leu Phe Tyr Gln Gly Ser Gln Thr Ala Lys Gln Leu Pro Val Ser
 260 265 270

Gln Val Lys Tyr Lys Gly Thr Trp Asp Phe Met Thr Asp Ala Lys Lys
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Gly Gln Ser Phe Ser Ser Phe Gly Thr Ser Gln Arg Leu Ala Gly Asp
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Arg Tyr Ser Ala Met Ser Tyr His Glu Tyr Pro Ser Leu Leu Thr Asp
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Glu Lys Asn Lys Pro Asp Asn Tyr Asn Gly Glu Tyr Gly His Ser Ser
 325 330 335

Glu Phe Thr Val Asp Phe Ser Lys Lys Ser Leu Lys Gly Glu Leu Ser
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Ser Asn Leu Gln Asp Gly His Lys Gly Ser Val Asn Lys Thr Lys Arg
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 Pro Val Phe Asn Ile Thr Gly Gln Ile Ala Gly Asn Gly Trp Thr Gly
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 Thr Ala Ser Thr Ala Lys Ala Asn Val Gly Gly Tyr Lys Ile Asp Ser
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 Ser Ser Thr Gly Lys Ser Ile Val Ile Glu Asn Ala Lys Val Thr Gly
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<212> DNA
<213> *Moraxella catarrhalis*

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agagtaaagc tgaggaaaaa accgaagcca tcttagatgc ctatgcactt gggacattta 7500
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agatggggcg gtcatttaca cacaacgccg atgacagcaa agcctctgtg gtctttggca 8220
caaaaagaca acaagaagtt aagtagtaat ttaaacacaa tgtttg 8266

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<212> PRT
<213> Moraxella catarrhalis

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Leu Lys Leu Ser Ala Leu Ser Leu Gly Leu Leu Asn Ile Thr Gln Val
                20                      25                      30

Ala Leu Ala Asn Thr Thr Ala Asp Lys Ala Glu Ala Thr Asp Lys Thr
  35                      40                      45

Asn Leu Val Val Val Leu Asp Glu Thr Val Val Thr Ala Lys Lys Asn
  50                      55                      60

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Ala	Arg	Lys	Ala	Asn	Glu	Val	Thr	Gly	Leu	Gly	Lys	Val	Val	Lys	Thr	65	70	75	80
Ala	Glu	Thr	Ile	Asn	Lys	Glu	Gln	Val	Leu	Asn	Ile	Arg	Asp	Leu	Thr	85	90	95	
Arg	Tyr	Asp	Pro	Gly	Ile	Ala	Val	Val	Glu	Gln	Gly	Arg	Gly	Ala	Ser	100	105	110	
Ser	Gly	Tyr	Ser	Ile	Arg	Gly	Met	Asp	Lys	Asn	Arg	Val	Ala	Val	Leu	115	120	125	
Val	Asp	Gly	Ile	Asn	Gln	Ala	Gln	His	Tyr	Ala	Leu	Gln	Gly	Pro	Val	130	135	140	
Ala	Gly	Lys	Asn	Tyr	Ala	Ala	Gly	Gly	Ala	Ile	Asn	Glu	Ile	Glu	Tyr	145	150	155	160
Glu	Asn	Val	Arg	Ser	Val	Glu	Ile	Ser	Lys	Gly	Ala	Asn	Ser	Ser	Glu	165	170		175
Tyr	Gly	Ser	Gly	Ala	Leu	Ser	Gly	Ser	Val	Ala	Phe	Val	Thr	Lys	Thr	180	185		190
Ala	Asp	Asp	Ile	Ile	Lys	Asp	Gly	Lys	Asp	Trp	Gly	Val	Gln	Thr	Lys	195	200		205
Thr	Ala	Tyr	Ala	Ser	Lys	Asn	Asn	Ala	Trp	Val	Asn	Ser	Val	Ala	Ala	210	215		220
Ala	Gly	Lys	Ala	Gly	Ser	Phe	Ser	Gly	Leu	Ile	Ile	Tyr	Thr	Asp	Arg	225	230		235
Arg	Gly	Gln	Glu	Tyr	Lys	Ala	His	Asp	Asp	Ala	Tyr	Gln	Gly	Ser	Gln	245	250		255
Ser	Phe	Asp	Arg	Ala	Val	Ala	Thr	Thr	Asp	Pro	Asn	Asn	Arg	Thr	Phe	260	265		270
Leu	Ile	Ala	Asn	Glu	Cys	Ala	Asn	Gly	Asn	Tyr	Glu	Ala	Cys	Ala	Ala	275	280		285
Gly	Gly	Gln	Thr	Lys	Leu	Gln	Ala	Lys	Pro	Thr	Asn	Val	Arg	Asp	Lys	290	295		300
Val	Asn	Val	Lys	Asp	Tyr	Thr	Gly	Pro	Asn	Arg	Leu	Ile	Pro	Asn	Pro	305	310		315
Leu	Thr	Gln	Asp	Ser	Lys	Ser	Leu	Leu	Leu	Arg	Pro	Gly	Tyr	Gln	Leu	325	330		335
Asn	Asp	Lys	His	Tyr	Val	Gly	Gly	Val	Tyr	Glu	Ile	Thr	Lys	Gln	Asn	340	345		350
Tyr	Ala	Met	Gln	Asp	Lys	Thr	Val	Pro	Ala	Tyr	Leu	Ala	Val	His	Asp	355	360		365

Ile Glu Lys Ser Arg Leu Ser Asn His Ala Gln Ala Asn Gly Tyr Tyr
 370 375 380
 Gln Gly Asn Asn Leu Gly Glu Arg Ile Arg Asp Thr Ile Gly Pro Asp
 385 390 395 400
 Ser Gly Tyr Gly Ile Asn Tyr Ala His Gly Val Phe Tyr Asp Glu Lys
 405 410 415
 His Gln Lys Asp Arg Leu Gly Leu Glu Tyr Val Tyr Asp Ser Lys Gly
 420 425 430
 Glu Asn Lys Trp Phe Asp Asp Val Arg Val Ser Tyr Asp Lys Gln Asp
 435 440 445
 Ile Thr Leu Arg Ser Gln Leu Thr Asn Thr His Cys Ser Thr Tyr Pro
 450 455 460
 His Ile Asp Lys Asn Cys Thr Pro Asp Val Asn Lys Pro Phe Ser Val
 465 470 475 480
 Lys Glu Val Asp Asn Asn Ala Tyr Lys Glu Gln His Asn Leu Ile Lys
 485 490 495
 Ala Val Phe Asn Lys Lys Met Ala Leu Gly Ser Thr His His His Ile
 500 505 510
 Asn Leu Gln Val Gly Tyr Asp Lys Phe Asn Ser Ser Leu Ser Arg Val
 515 520 525
 Glu Tyr Arg Leu Ala Thr His Gln Ser Tyr Gln Lys Leu Asp Tyr Thr
 530 535 540
 Pro Pro Ser Asn Pro Leu Pro Asp Lys Phe Lys Pro Ile Leu Gly Ser
 545 550 555 560
 Asn Asn Lys Pro Ile Cys Leu Asp Ala Tyr Gly Tyr Gly His Asp His
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 Pro Gln Ala Cys Asn Ala Lys Asn Ser Thr Tyr Gln Asn Phe Ala Ile
 580 585 590
 Lys Lys Gly Ile Glu Gln Tyr Asn Gln Lys Thr Asn Thr Asp Lys Ile
 595 600 605
 Asp Tyr Gln Ala Ile Ile Asp Gln Tyr Asp Lys Gln Asn Pro Asn Ser
 610 615 620
 Thr Leu Lys Pro Phe Glu Lys Ile Lys Gln Ser Leu Gly Gln Glu Lys
 625 630 635 640
 Tyr Asn Lys Ile Asp Glu Leu Gly Phe Lys Ala Tyr Lys Asp Leu Arg
 645 650 655
 Asn Glu Trp Ala Gly Trp Thr Asn Asp Asn Ser Gln Gln Asn Ala Asn
 660 665 670

Lys Gly Thr Asp Asn Ile Tyr Gln Pro Asn Gln Ala Thr Val Val Lys
 675 680 685
 Asp Asp Lys Cys Lys Tyr Ser Glu Thr Asn Ser Tyr Ala Asp Cys Ser
 690 695 700
 Thr Thr Arg His Ile Ser Gly Asp Asn Tyr Phe Ile Ala Leu Lys Asp
 705 710 715 720
 Asn Met Thr Ile Asn Lys Tyr Val Asp Leu Gly Leu Gly Ala Arg Tyr
 725 730 735
 Asp Arg Ile Lys His Lys Ser Asp Val Pro Leu Val Asp Asn Ser Ala
 740 745 750
 Ser Asn Gln Leu Ser Trp Asn Phe Gly Val Val Val Lys Pro Thr Asn
 755 760 765
 Trp Leu Asp Ile Ala Tyr Arg Ser Ser Gln Gly Phe Arg Met Pro Ser
 770 775 780
 Phe Ser Glu Met Tyr Gly Glu Arg Phe Gly Val Thr Ile Gly Lys Gly
 785 790 795 800
 Thr Gln His Gly Cys Lys Gly Leu Tyr Tyr Ile Cys Gln Gln Thr Val
 805 810 815
 His Gln Thr Lys Leu Lys Pro Glu Lys Ser Phe Asn Gln Glu Ile Gly
 820 825 830
 Ala Thr Leu His Asn His Leu Gly Ser Leu Glu Val Ser Tyr Phe Lys
 835 840 845
 Asn Arg Tyr Thr Asp Leu Ile Val Gly Lys Ser Glu Glu Ile Arg Thr
 850 855 860
 Leu Thr Gln Gly Asp Asn Ala Gly Lys Gln Arg Gly Lys Gly Asp Leu
 865 870 875 880
 Gly Phe His Asn Gly Gln Asp Ala Asp Leu Thr Gly Ile Asn Ile Leu
 885 890 895
 Gly Arg Leu Asp Leu Asn Ala Ala Asn Ser Arg Leu Pro Tyr Gly Leu
 900 905 910
 Tyr Ser Thr Leu Ala Tyr Asn Lys Val Asp Val Lys Gly Lys Thr Leu
 915 920 925
 Asn Pro Thr Leu Ala Gly Thr Asn Ile Leu Phe Asp Ala Ile Gln Pro
 930 935 940
 Ser Arg Tyr Val Val Gly Leu Gly Tyr Asp Ala Pro Ser Gln Lys Trp
 945 950 955 960
 Gly Ala Asn Ala Ile Phe Thr His Ser Asp Ala Lys Asn Pro Ser Glu
 965 970 975

Leu Leu Ala Asp Lys Asn Leu Gly Asn Gly Asn Ile Gln Thr Lys Gln
 980 985 990
 Ala Thr Lys Ala Lys Ser Thr Pro Trp Gln Thr Leu Asp Leu Ser Gly
 995 1000 1005
 Tyr Val Asn Ile Lys Asp Asn Phe Thr Leu Arg Ala Gly Val Tyr Asn
 1010 1015 1020
 Val Phe Asn Thr Tyr Tyr Thr Thr Trp Glu Ala Leu Arg Gln Thr Ala
 1025 1030 1035 1040
 Lys Gly Ala Val Asn Gln His Thr Gly Leu Ser Gln Asp Lys His Tyr
 1045 1050 1055
 Gly Arg Tyr Ala Ala Pro Gly Arg Asn Tyr Gln Leu Ala Leu Glu Met
 1060 1065 1070
 Lys Phe Met Leu Ala Phe Leu Ile Gly Ala Val Met Thr Ile Thr Pro
 1075 1080 1085
 Val Tyr Thr Thr Phe Thr Pro Thr Lys Thr Pro Ile Lys Phe Phe Met
 1090 1095 1100
 Ala Gly Leu Thr Phe Leu Ile Ala His Ile Ser His Ala Asp Asp Gly
 1105 1110 1115 1120
 Arg Thr Asp Asn Gln Glu Leu Ile Asn Gln Glu Ile Ala Thr Leu Glu
 1125 1130 1135
 Pro Ile Ile Asn His Ala Gln Pro Glu Leu Leu Ser His Asp Ala Leu
 1140 1145 1150
 Thr Pro Lys Ile Glu Pro Ile Leu Ala Gln Thr Pro Asn Pro Ala Glu
 1155 1160 1165
 Asp Thr Leu Ile Ala Asp Glu Ala Leu Leu Leu Asp Asn Pro Asp Leu
 1170 1175 1180
 Leu Asn His Ala Leu Asn Ser Ala Val Met Thr Asn His Met Ala Gly
 1185 1190 1195 1200
 Val His Ala Leu Leu Pro Ile Tyr Gln Lys Leu Pro Lys Asp His Gln
 1205 1210 1215
 Asn Gly Ile Leu Leu Gly Tyr Ala Asn Ala Leu Ala Ala Leu Asp Lys
 1220 1225 1230
 Gly Asn Ala Lys Lys Ala Ile Asp Glu Leu Arg Arg Ile Ile Ala Ile
 1235 1240 1245
 Met Pro Glu Tyr Asn Val Val Arg Phe His Leu Ala Arg Ala Leu Phe
 1250 1255 1260
 Met Asp Lys Gln Asn Glu Ala Ala Leu Asp Gln Phe Asn Lys Leu His
 1265 1270 1275 1280

Ala Asp Asn Leu Pro Glu Glu Val Arg Gln Val Val Gly Gln Tyr Arg
 1285 1290 1295
 Gln Ala Leu Lys Gln Arg Asp Ser Trp Thr Trp Gln Val Gly Met Asn
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 Leu Ala Lys Glu Asp Asn Ile Asn Gln Thr Pro Lys Asn Thr Thr Gln
 1315 1320 1325
 Gly Gln Trp Thr Phe Asp Lys Pro Ile Asp Ala Ile Thr Leu Ser Tyr
 1330 1335 1340
 Gln Leu Gly Ala Asp Lys Lys Trp Ser Leu Pro Lys Gly Ala Tyr Val
 1345 1350 1355 1360
 Gly Ala Asn Ala Gln Ile Tyr Gly Lys His His Gln Asn His Lys Lys
 1365 1370 1375
 Tyr Asn Asp His Trp Gly Arg Leu Gly Ala Asn Leu Gly Phe Ala Asp
 1380 1385 1390
 Ala Lys Lys Asp Leu Ser Ile Glu Thr Tyr Gly Glu Lys Arg Phe Tyr
 1395 1400 1405
 Gly His Glu Arg Tyr Thr Asp Thr Ile Gly Ile Arg Met Ser Val Asp
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 Tyr Arg Ile Asn Pro Lys Phe Gln Ser Leu Asn Ala Ile Asp Ile Ser
 1425 1430 1435 1440
 Arg Leu Thr Asn His Arg Thr Pro Arg Ala Asp Ser Asn Asn Thr Leu
 1445 1450 1455
 Tyr Ser Thr Ser Leu Ile Tyr Tyr Pro Asn Ala Thr Arg Tyr Tyr Leu
 1460 1465 1470
 Leu Gly Ala Asp Phe Tyr Asp Glu Lys Val Pro Gln Asp Pro Ser Asp
 1475 1480 1485
 Ser Tyr Gln Arg Arg Gly Ile Arg Thr Ala Trp Gly Gln Glu Trp Ala
 1490 1495 1500
 Gly Gly Leu Ser Ser Arg Ala Gln Ile Ser Ile Asn Lys Arg His Tyr
 1505 1510 1515 1520
 Gln Gly Ala Asn Leu Thr Ser Gly Gly Gln Ile Arg His Asp Lys Gln
 1525 1530 1535
 Met Gln Ala Ser Leu Ser Leu Trp His Arg Asp Ile His Lys Trp Gly
 1540 1545 1550
 Ile Thr Pro Arg Leu Thr Ile Ser Thr Asn Ile Asn Lys Ser Asn Asp
 1555 1560 1565
 Ile Lys Ala Asn Tyr His Lys Asn Gln Met Phe Val Glu Phe Ser Arg
 1570 1575 1580
 Ile Phe Met Lys His Ile Pro Leu Thr Thr Leu Cys Val Ala Ile Ser
 1585 1590 1595 1600

Ala Val Leu Leu Thr Ala Cys Gly Gly Ser Gly Gly Ser Asn Pro Pro
1605 1610 1615

Ala Pro Thr Pro Ile Pro Asn Ala Ser Gly Ser Gly Asn Thr Gly Asn
1620 1625 1630

Thr Gly Asn Ala Gly Gly Thr Asp Asn Thr Ala Asn Ala Gly Asn Thr
1635 1640 1645

Gly Gly Thr Asn Ser Gly Thr Gly Ser Ala Asn Thr Pro Glu Pro Lys
1650 1655 1660

Tyr Gln Asp Val Pro Thr Glu Lys Asn Glu Lys Asp Lys Val Ser Ser
1665 1670 1675 1680

Ile Gln Glu Pro Ala Met Gly Tyr Gly Met Ala Leu Ser Lys Ile Asn
1685 1690 1695

Leu His Asn Arg Gln Asp Thr Pro Leu Asp Glu Lys Asn Ile Ile Thr
1700 1705 1710

Leu Asp Gly Lys Lys Gln Val Ala Glu Gly Lys Lys Ser Pro Leu Pro
1715 1720 1725

Phe Ser Leu Asp Val Glu Asn Lys Leu Leu Asp Gly Tyr Ile Ala Lys
1730 1735 1740

Met Asn Val Ala Asp Lys Asn Ala Ile Gly Asp Arg Ile Lys Lys Gly
1745 1750 1755 1760

Asn Lys Glu Ile Ser Asp Glu Glu Leu Ala Lys Gln Ile Lys Glu Ala
1765 1770 1775

Val Arg Lys Ser His Glu Phe Gln Gln Val Leu Ser Ser Leu Glu Asn
1780 1785 1790

Lys Ile Phe His Ser Asn Asp Gly Thr Thr Lys Ala Thr Thr Arg Asp
1795 1800 1805

Leu Lys Tyr Val Asp Tyr Gly Tyr Tyr Leu Ala Asn Asp Gly Asn Tyr
1810 1815 1820

Leu Thr Val Lys Thr Asp Lys Leu Trp Asn Leu Gly Pro Val Gly Gly
1825 1830 1835 1840

Val Phe Tyr Asn Gly Thr Thr Thr Ala Lys Glu Leu Pro Thr Gln Asp
1845 1850 1855

Ala Val Lys Tyr Lys Gly His Trp Asp Phe Met Thr Asp Val Ala Asn
1860 1865 1870

Arg Arg Asn Arg Phe Ser Glu Val Lys Glu Asn Ser Gln Ala Gly Trp
1875 1880 1885

Tyr Tyr Gly Ala Ser Ser Lys Asp Glu Tyr Asn Arg Leu Leu Thr Lys
1890 1895 1900

Glu Asp Ser Ala Pro Asp Gly His Ser Gly Glu Tyr Gly His Ser Ser
 1905 1910 1915 1920

Glu Phe Thr Val Asn Phe Lys Glu Lys Lys Leu Thr Gly Lys Leu Phe
 1925 1930 1935

Ser Asn Leu Gln Asp Arg His Lys Gly Asn Val Thr Lys Thr Glu Arg
 1940 1945 1950

Tyr Asp Ile Asp Ala Asn Ile His Gly Asn Arg Phe Arg Gly Ser Ala
 1955 1960 1965

Thr Ala Ser Asn Lys Asn Asp Thr Ser Lys His Pro Phe Thr Ser Asp
 1970 1975 1980

Ala Asn Asn Arg Leu Glu Gly Gly Phe Tyr Gly Pro Lys Gly Glu Glu
 1985 1990 1995 2000

Leu Ala Gly Lys Phe Leu Thr Asn Asp Asn Lys Leu Phe Gly Val Phe
 2005 2010 2015

Gly Ala Lys Arg Glu Ser Lys Ala Glu Glu Lys Thr Glu Ala Ile Leu
 2020 2025 2030

Asp Ala Tyr Ala Leu Gly Thr Phe Asn Thr Ser Asn Ala Thr Thr Phe
 2035 2040 2045

Thr Pro Phe Thr Glu Lys Gln Leu Asp Asn Phe Gly Asn Ala Lys Lys
 2050 2055 2060

Leu Val Leu Gly Ser Thr Val Ile Asp Leu Val Pro Thr Asp Ala Thr
 2065 2070 2075 2080

Lys Asn Glu Phe Thr Lys Asp Lys Pro Glu Ser Ala Thr Asn Glu Ala
 2085 2090 2095

Gly Glu Thr Leu Met Val Asn Asp Glu Val Ser Val Lys Thr Tyr Gly
 2100 2105 2110

Lys Asn Phe Glu Tyr Leu Lys Phe Gly Glu Leu Ser Ile Gly Gly Ser
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His Ser Val Phe Leu Gln Gly Glu Arg Thr Ala Thr Thr Gly Glu Lys
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Ala Val Pro Thr Thr Gly Thr Ala Lys Tyr Leu Gly Asn Trp Val Gly
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Tyr Ile Thr Gly Lys Asp Thr Gly Thr Gly Thr Gly Lys Ser Phe Thr
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Asp Ala Gln Asp Val Ala Asp Phe Asp Ile Asp Phe Gly Asn Lys Ser
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Val Ser Gly Lys Leu Ile Thr Lys Gly Arg Gln Asp Pro Val Phe Ser
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Ile Thr Gly Gln Ile Ala Gly Asn Gly Trp Thr Gly Thr Ala Ser Thr
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Thr Lys Ala Asp Ala Gly Gly Tyr Lys Ile Asp Ser Ser Ser Thr Gly
2225 2230 2235 2240

Lys Ser Ile Ala Ile Lys Asp Ala Asn Val Thr Gly Gly Phe Tyr Gly
2245 2250 2255

Pro Asn Ala Asn Glu Met Gly Gly Ser Phe Thr His Asn Ala Asp Asp
2260 2265 2270

Ser Lys Ala Ser Val Val Phe Gly Thr Lys Arg Gln Gln Glu Val Lys
2275 2280 2285

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<212> PRT

<213> *Moraxella catarrhalis*

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Ala Leu Ala Asn Thr Thr Ala Asp Lys Ala Glu Ala Thr Asp Lys Thr
35 40 45

Asn Leu Val Val Val Leu Asp Glu Thr Val Val Thr Ala Lys Lys Asn
50 55 60

Ala Arg Lys Ala Asn Glu Val Thr Gly Leu Gly Lys Val Val Lys Thr
65 70 75 80

Ala Glu Thr Ile Asn Lys Glu Gln Val Leu Asn Ile Arg Asp Leu Thr
85 90 95

Arg Tyr Asp Pro Gly Ile Ala Val Val Glu Gln Gly Arg Gly Ala Ser
100 105 110

Ser Gly Tyr Ser Ile Arg Gly Met Asp Lys Asn Arg Val Ala Val Leu
115 120 125

Val Asp Gly Ile Asn Gln Ala Gln His Tyr Ala Leu Gln Gly Pro Val
130 135 140

Ala Gly Lys Asn Tyr Ala Ala Gly Gly Ala Ile Asn Glu Ile Glu Tyr
145 150 155 160

Glu Asn Val Arg Ser Val Glu Ile Ser Lys Gly Ala Asn Ser Ser Glu
165 170 175

Tyr Gly Ser Gly Ala Leu Ser Gly Ser Val Ala Phe Val Thr Lys Thr
180 185 190

Ala Asp Asp Ile Ile Lys Asp Gly Lys Asp Trp Gly Val Gln Thr Lys
195 200 205

Thr	Ala	Tyr	Ala	Ser	Lys	Asn	Asn	Ala	Trp	Val	Asn	Ser	Val	Ala	Ala		
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Ala	Gly	Lys	Ala	Gly	Ser	Phe	Ser	Gly	Leu	Ile	Ile	Tyr	Thr	Asp	Arg		
225					230					235					240		
Arg	Gly	Gln	Glu	Tyr	Lys	Ala	His	Asp	Asp	Ala	Tyr	Gln	Gly	Ser	Gln		
				245					250					255			
Ser	Phe	Asp	Arg	Ala	Val	Ala	Thr	Thr	Asp	Pro	Asn	Asn	Arg	Thr	Phe		
			260					265						270			
Leu	Ile	Ala	Asn	Glu	Cys	Ala	Asn	Gly	Asn	Tyr	Glu	Ala	Cys	Ala	Ala		
	275						280					285					
Gly	Gly	Gln	Thr	Lys	Leu	Gln	Ala	Lys	Pro	Thr	Asn	Val	Arg	Asp	Lys		
	290					295					300						
Val	Asn	Val	Lys	Asp	Tyr	Thr	Gly	Pro	Asn	Arg	Leu	Ile	Pro	Asn	Pro		
305					310					315					320		
Leu	Thr	Gln	Asp	Ser	Lys	Ser	Leu	Leu	Leu	Arg	Pro	Gly	Tyr	Gln	Leu		
				325					330					335			
Asn	Asp	Lys	His	Tyr	Val	Gly	Gly	Val	Tyr	Glu	Ile	Thr	Lys	Gln	Asn		
			340					345					350				
Tyr	Ala	Met	Gln	Asp	Lys	Thr	Val	Pro	Ala	Tyr	Leu	Ala	Val	His	Asp		
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Ile	Glu	Lys	Ser	Arg	Leu	Ser	Asn	His	Ala	Gln	Ala	Asn	Gly	Tyr	Tyr		
	370					375					380						
Gln	Gly	Asn	Asn	Leu	Gly	Glu	Arg	Ile	Arg	Asp	Thr	Ile	Gly	Pro	Asp		
385					390					395					400		
Ser	Gly	Tyr	Gly	Ile	Asn	Tyr	Ala	His	Gly	Val	Phe	Tyr	Asp	Glu	Lys		
				405					410					415			
His	Gln	Lys	Asp	Arg	Leu	Gly	Leu	Glu	Tyr	Val	Tyr	Asp	Ser	Lys	Gly		
			420					425					430				
Glu	Asn	Lys	Trp	Phe	Asp	Asp	Val	Arg	Val	Ser	Tyr	Asp	Lys	Gln	Asp		
		435					440					445					
Ile	Thr	Leu	Arg	Ser	Gln	Leu	Thr	Asn	Thr	His	Cys	Ser	Thr	Tyr	Pro		
	450					455					460						
His	Ile	Asp	Lys	Asn	Cys	Thr	Pro	Asp	Val	Asn	Lys	Pro	Phe	Ser	Val		
465					470					475					480		
Lys	Glu	Val	Asp	Asn	Asn	Ala	Tyr	Lys	Glu	Gln	His	Asn	Leu	Ile	Lys		
				485					490					495			
Ala	Val	Phe	Asn	Lys	Lys	Met	Ala	Leu	Gly	Ser	Thr	His	His	His	Ile		
			500					505					510				
Asn	Leu	Gln	Val	Gly	Tyr	Asp	Lys	Phe	Asn	Ser	Ser	Leu	Ser	Arg	Val		
		515					520					525					

Glu	Tyr	Arg	Leu	Ala	Thr	His	Gln	Ser	Tyr	Gln	Lys	Leu	Asp	Tyr	Thr	530	535	540
Pro	Pro	Ser	Asn	Pro	Leu	Pro	Asp	Lys	Phe	Lys	Pro	Ile	Leu	Gly	Ser	545	550	555
Asn	Asn	Lys	Pro	Ile	Cys	Leu	Asp	Ala	Tyr	Gly	Tyr	Gly	His	Asp	His	565	570	575
Pro	Gln	Ala	Cys	Asn	Ala	Lys	Asn	Ser	Thr	Tyr	Gln	Asn	Phe	Ala	Ile	580	585	590
Lys	Lys	Gly	Ile	Glu	Gln	Tyr	Asn	Gln	Lys	Thr	Asn	Thr	Asp	Lys	Ile	595	600	605
Asp	Tyr	Gln	Ala	Ile	Ile	Asp	Gln	Tyr	Asp	Lys	Gln	Asn	Pro	Asn	Ser	610	615	620
Thr	Leu	Lys	Pro	Phe	Glu	Lys	Ile	Lys	Gln	Ser	Leu	Gly	Gln	Glu	Lys	625	630	635
Tyr	Asn	Lys	Ile	Asp	Glu	Leu	Gly	Phe	Lys	Ala	Tyr	Lys	Asp	Leu	Arg	645	650	655
Asn	Glu	Trp	Ala	Gly	Trp	Thr	Asn	Asp	Asn	Ser	Gln	Gln	Asn	Ala	Asn	660	665	670
Lys	Gly	Thr	Asp	Asn	Ile	Tyr	Gln	Pro	Asn	Gln	Ala	Thr	Val	Val	Lys	675	680	685
Asp	Asp	Lys	Cys	Lys	Tyr	Ser	Glu	Thr	Asn	Ser	Tyr	Ala	Asp	Cys	Ser	690	695	700
Thr	Thr	Arg	His	Ile	Ser	Gly	Asp	Asn	Tyr	Phe	Ile	Ala	Leu	Lys	Asp	705	710	715
Asn	Met	Thr	Ile	Asn	Lys	Tyr	Val	Asp	Leu	Gly	Leu	Gly	Ala	Arg	Tyr	725	730	735
Asp	Arg	Ile	Lys	His	Lys	Ser	Asp	Val	Pro	Leu	Val	Asp	Asn	Ser	Ala	740	745	750
Ser	Asn	Gln	Leu	Ser	Trp	Asn	Phe	Gly	Val	Val	Val	Lys	Pro	Thr	Asn	755	760	765
Trp	Leu	Asp	Ile	Ala	Tyr	Arg	Ser	Ser	Gln	Gly	Phe	Arg	Met	Pro	Ser	770	775	780
Phe	Ser	Glu	Met	Tyr	Gly	Glu	Arg	Phe	Gly	Val	Thr	Ile	Gly	Lys	Gly	785	790	795
Thr	Gln	His	Gly	Cys	Lys	Gly	Leu	Tyr	Tyr	Ile	Cys	Gln	Gln	Thr	Val	805	810	815
His	Gln	Thr	Lys	Leu	Lys	Pro	Glu	Lys	Ser	Phe	Asn	Gln	Glu	Ile	Gly	820	825	830

Ala Thr Leu His Asn His Leu Gly Ser Leu Glu Val Ser Tyr Phe Lys
835 840 845

Asn Arg Tyr Thr Asp Leu Ile Val Gly Lys Ser Glu Glu Ile Arg Thr
850 855 860

Leu Thr Gln Gly Asp Asn Ala Gly Lys Gln Arg Gly Lys Gly Asp Leu
865 870 875 880

Gly Phe His Asn Gly Gln Asp Ala Asp Leu Thr Gly Ile Asn Ile Leu
885 890 895

Gly Arg Leu Asp Leu Asn Ala Ala Asn Ser Arg Leu Pro Tyr Gly Leu
900 905 910

Tyr Ser Thr Leu Ala Tyr Asn Lys Val Asp Val Lys Gly Lys Thr Leu
915 920 925

Asn Pro Thr Leu Ala Gly Thr Asn Ile Leu Phe Asp Ala Ile Gln Pro
930 935 940

Ser Arg Tyr Val Val Gly Leu Gly Tyr Asp Ala Pro Ser Gln Lys Trp
945 950 955 960

Gly Ala Asn Ala Ile Phe Thr His Ser Asp Ala Lys Asn Pro Ser Glu
965 970 975

Leu Leu Ala Asp Lys Asn Leu Gly Asn Gly Asn Ile Gln Thr Lys Gln
980 985 990

Ala Thr Lys Ala Lys Ser Thr Pro Trp Gln Thr Leu Asp Leu Ser Gly
995 1000 1005

Tyr Val Asn Ile Lys Asp Asn Phe Thr Leu Arg Ala Gly Val Tyr Asn
1010 1015 1020

Val Phe Asn Thr Tyr Tyr Thr Thr Trp Glu Ala Leu Arg Gln Thr Ala
1025 1030 1035 1040

Lys Gly Ala Val Asn Gln His Thr Gly Leu Ser Gln Asp Lys His Tyr
1045 1050 1055

Gly Arg Tyr Ala Ala Pro Gly Arg Asn Tyr Gln Leu Ala Leu Glu Met
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Lys Phe

<210> 13
<211> 1539
<212> DNA
<213> *Moraxella catarrhalis*

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gaggcggttac tgcttgataa ccctgatttg ctcaatcacg ccctaaattc tgctgtcatg 360
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catcaaaatg gcattttact tgggtatgcc aatgccttgg ctgctttgga taagggaac 480
gccaaaaaag ccattgatga gctacgtcgc atcatcgcca tcatgcctga atataatgtg 540
gtgcgttttc atctggcaag ggcattattt atggacaaac aaaatgaagc cgcccttgac 600
cagtttaata aattacatgc tgacaacttg ccagaggagg tgcggcaggt tgttgggcag 660
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<210> 14

<211> 512

<212> PRT

<213> *Moraxella catarrhalis*

<400> 14

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```

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Thr Thr Phe Thr Pro Thr Lys Thr Pro Ile Lys Phe Phe Met Ala Gly
          20             25             30

```

```

Leu Thr Phe Leu Ile Ala His Ile Ser His Ala Asp Asp Gly Arg Thr
          35             40             45

```

```

Asp Asn Gln Glu Leu Ile Asn Gln Glu Ile Ala Thr Leu Glu Pro Ile
          50             55             60

```

```

Ile Asn His Ala Gln Pro Glu Leu Leu Ser His Asp Ala Leu Thr Pro
          65             70             75             80

```

```

Lys Ile Glu Pro Ile Leu Ala Gln Thr Pro Asn Pro Ala Glu Asp Thr
          85             90             95

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```

Leu Ile Ala Asp Glu Ala Leu Leu Leu Asp Asn Pro Asp Leu Leu Asn
          100             105             110

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His Ala Leu Asn Ser Ala Val Met Thr Asn His Met Ala Gly Val His
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Ala Leu Leu Pro Ile Tyr Gln Lys Leu Pro Lys Asp His Gln Asn Gly
          130             135             140

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 Ala Lys Lys Ala Ile Asp Glu Leu Arg Arg Ile Ile Ala Ile Met Pro
 165 170 175
 Glu Tyr Asn Val Val Arg Phe His Leu Ala Arg Ala Leu Phe Met Asp
 180 185 190
 Lys Gln Asn Glu Ala Ala Leu Asp Gln Phe Asn Lys Leu His Ala Asp
 195 200 205
 Asn Leu Pro Glu Glu Val Arg Gln Val Val Gly Gln Tyr Arg Gln Ala
 210 215 220
 Leu Lys Gln Arg Asp Ser Trp Thr Trp Gln Val Gly Met Asn Leu Ala
 225 230 235 240
 Lys Glu Asp Asn Ile Asn Gln Thr Pro Lys Asn Thr Thr Gln Gly Gln
 245 250 255
 Trp Thr Phe Asp Lys Pro Ile Asp Ala Ile Thr Leu Ser Tyr Gln Leu
 260 265 270
 Gly Ala Asp Lys Lys Trp Ser Leu Pro Lys Gly Ala Tyr Val Gly Ala
 275 280 285
 Asn Ala Gln Ile Tyr Gly Lys His His Gln Asn His Lys Lys Tyr Asn
 290 295 300
 Asp His Trp Gly Arg Leu Gly Ala Asn Leu Gly Phe Ala Asp Ala Lys
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 Lys Asp Leu Ser Ile Glu Thr Tyr Gly Glu Lys Arg Phe Tyr Gly His
 325 330 335
 Glu Arg Tyr Thr Asp Thr Ile Gly Ile Arg Met Ser Val Asp Tyr Arg
 340 345 350
 Ile Asn Pro Lys Phe Gln Ser Leu Asn Ala Ile Asp Ile Ser Arg Leu
 355 360 365
 Thr Asn His Arg Thr Pro Arg Ala Asp Ser Asn Asn Thr Leu Tyr Ser
 370 375 380
 Thr Ser Leu Ile Tyr Tyr Pro Asn Ala Thr Arg Tyr Tyr Leu Leu Gly
 385 390 395 400
 Ala Asp Phe Tyr Asp Glu Lys Val Pro Gln Asp Pro Ser Asp Ser Tyr
 405 410 415
 Gln Arg Arg Gly Ile Arg Thr Ala Trp Gly Gln Glu Trp Ala Gly Gly
 420 425 430
 Leu Ser Ser Arg Ala Gln Ile Ser Ile Asn Lys Arg His Tyr Gln Gly
 435 440 445
 Ala Asn Leu Thr Ser Gly Gly Gln Ile Arg His Asp Lys Gln Met Gln
 450 455 460

Ala Ser Leu Ser Leu Trp His Arg Asp Ile His Lys Trp Gly Ile Thr
465 470 475 480

Pro Arg Leu Thr Ile Ser Thr Asn Ile Asn Lys Ser Asn Asp Ile Lys
485 490 495

Ala Asn Tyr His Lys Asn Gln Met Phe Val Glu Phe Ser Arg Ile Phe
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<210> 15

<211> 2109

<212> DNA

<213> *Moraxella catarrhalis*

<400> 15

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<210> 16

<211> 512

<212> PRT

<213> *Moraxella catarrhalis*

<400> 16

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			20					25					30		
Leu	Thr	Phe	Leu	Ile	Ala	His	Ile	Ser	His	Ala	Asp	Asp	Gly	Arg	Thr
		35					40					45			
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	50					55					60				
Ile	Asn	His	Ala	Gln	Pro	Glu	Leu	Leu	Ser	His	Asp	Ala	Leu	Thr	Pro
65					70					75					80
Lys	Ile	Glu	Pro	Ile	Leu	Ala	Gln	Thr	Pro	Asn	Pro	Ala	Glu	Asp	Thr
				85					90					95	
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			100					105					110		
His	Ala	Leu	Asn	Ser	Ala	Val	Met	Thr	Asn	Asn	Met	Ala	Gly	Val	His
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	130					135					140				
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145					150					155					160
Ala	Lys	Ala	Ala	Ile	Gly	Glu	Leu	Arg	Arg	Ile	Ile	Ala	Ile	Met	Pro
				165					170					175	
Glu	Tyr	Asn	Val	Val	Arg	Phe	His	Leu	Ala	Arg	Ala	Leu	Phe	Met	Asp
			180					185					190		
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	210					215					220				
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225					230					235					240
Lys	Glu	Asp	Asn	Ile	Asn	Gln	Thr	Pro	Lys	Asn	Thr	Thr	Gln	Gly	Gln
				245					250					255	
Trp	Thr	Phe	Asp	Lys	Pro	Ile	Asp	Ala	Ile	Thr	Leu	Ser	Tyr	Gln	Leu
			260					265					270		
Gly	Ala	Asp	Lys	Lys	Trp	Ser	Leu	Pro	Lys	Gly	Ala	Tyr	Val	Gly	Ala
		275					280					285			
Asn	Ala	Gln	Ile	Tyr	Gly	Lys	His	His	Gln	Asn	His	Lys	Lys	Tyr	Asn
	290					295					300				

Asp His Trp Gly Arg Leu Gly Ala Asn Leu Gly Phe Ala Asp Ala Lys
 305 310 315 320
 Lys Asp Leu Ser Ile Glu Thr Tyr Gly Glu Lys Arg Phe Tyr Gly His
 325 330 335
 Glu Arg Tyr Thr Asp Thr Ile Gly Ile Arg Met Ser Ala Asp Tyr Arg
 340 345 350
 Ile Asn Pro Lys Phe Gln Ser Leu Asn Ala Ile Asp Ile Ser Arg Leu
 355 360 365
 Thr Asn His Arg Thr Pro Arg Ala Asp Ser Asn Asn Thr Leu Tyr Ser
 370 375 380
 Thr Ser Leu Ile Tyr Tyr Pro Asn Ala Thr Arg Tyr Tyr Leu Leu Gly
 385 390 395 400
 Ala Asp Phe Tyr Asp Glu Lys Val Pro Gln Asp Pro Ser Asp Ser Tyr
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 Glu Arg Arg Gly Ile Arg Thr Ala Trp Gly Gln Glu Trp Ala Gly Gly
 420 425 430
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 Ala Ser Leu Ser Leu Trp His Arg Asp Ile His Lys Trp Gly Ile Thr
 465 470 475 480
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<210> 17
 <211> 10
 <212> PRT
 <213> Moraxella catarrhalis

<400> 17
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<210> 18
 <211> 30
 <212> DNA
 <213> Moraxella catarrhalis

<400> 18
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<210> 19
 <211> 30
 <212> DNA
 <213> *Moraxella catarrhalis*

 <400> 19
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30

<210> 20
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 <213> *Moraxella catarrhalis*

<400> 20
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23

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 <212> DNA
 <213> *Moraxella catarrhalis*

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25

<210> 22
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